

12. (Twice Amended) A motor system including a variable reluctance motor comprising at least one phase coil having a first number of turns, said system further comprising:

B4 a motor speed sensor coupled to said variable reluctance motor for sensing a speed of said variable reluctance motor;

a switch coupled to said phase coil of said variable reluctance motor; and

a driving circuit coupled to said motor speed sensor and to said switch such that said switch changes the number of turns of said phase coil from said first number to a second number when said speed of said variable reluctance motor reaches a reference value, whereby the force delivered by said variable reluctance motor is maintained.

REMARKS

Examiner Fletcher is thanked for the courtesies extended to the undersigned during the interview of June 4, 2003. During the interview, the claim amendments set forth in this paper were discussed. It was agreed during the interview that the prior art used in the outstanding rejections did not disclose (1) a variable reluctance motor or (2) a method of maintaining the force delivered by a variable reluctance motor as recited in the pending claims.

The Office Action of January 2, 2003, has been received and considered. In the Office Action, claims 1-13 were rejected under either 35 U.S.C. §102 or 35 U.S.C. §103(a).

Claims 3, 8-10 and 13 have been cancelled. Claims 1, 2, 4-6, 11 and 12 have been amended. Claims 1, 2, 4-7, 11 and 12 are presently pending. Reconsideration of the application is respectfully requested.

The present invention includes a method and apparatus for maintaining the force delivered by a variable reluctance motor having at least one phase coil as the speed of the motor changes. Unlike conventional, single phase motors, such as those disclosed in the cited publications, the force delivered by the variable reluctance motor according to the present invention does not decrease as the motor velocity increases. Instead, as a sensor senses the increasing speed of the variable reluctance motor, the inductance of the phase coil is varied. As a result, the force of the variable reluctance motor according to the present invention is maintained while the speed of the motor changes.

The specification of the present application illustrates an embodiment of the variable reluctance motor comprising a phase coil having a first portion (206a) with a first number of turns and a second portion (206b) with a second number of turns. The motor also includes (1) a speed sensor for sensing the speed of the motor and (2) an inductance switch for varying the inductance of the phase coil by changing the number of turns of the phase coil from a first number of turns to a second number of turns based on the sensed speed. Switching the number of turns of the phase coil has the effect of maintaining the force of the motor as the speed of the motor increases.

Claims 1-4, 6-10 and 13 were rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 4,322,665 to Landgraf that discloses a **single phase** induction rotary motor with constant power supply frequency. As is well known in the art, a single phase motor is different from a variable reluctance motor. Similarly, single

phase motors and variable reluctance motors operate in different manners as discussed during the interview. Also, unlike the present invention, the Landgraf motor includes separate winding sets. The Landgraf motor includes main winding sets and supplemental winding sets. The motor does not include a single coil that has its number of energized coils varied as recited in the pending claims. Therefore, as clearly understood in the art, the motor disclosed in the patent to Landgraf cannot anticipate the variable reluctance motor recited in the pending claims.

In addition to its failure to disclose the recited variable reluctance motor, the patent to Landgraf also fails to disclose the method recited in claim 1. The patent to Landgraf does not disclose (1) sensing the motor speed of a variable reluctance motor during its operation and (2) varying the inductance of the coil of the variable reluctance motor based on the sensed speed. Instead, the single phase motor disclosed in the patent to Landgraf is operated in only one of two different and distinct operating modes. The Landgraf motor is operated in either a high speed mode or a low speed mode. During high speed (3600 RPM) operation of the Landgraf motor, the winding sets are connected to an electrical power source so that the number of effective turns is the sum of the turns of one main winding coil set and a separate, supplemental winding coil set. During low speed operation (1800 RPM), only the turns in the main winding coil set are energized so that a fewer number of turns are energized at a lower speed.

The method described by Landgraf does not include any motor speed sensing during the operation of the motor. Instead, the patent to Landgraf only discloses that the appropriate coil sets corresponding to the selected speed mode are energized at the time that the operator chooses the mode of operation. Additionally, the motor does not vary

the inductance, number of turns, of the same coil based on the sensed speed of the motor.

As a result, the patent to Landgraf does not disclose the method recited in claim 1.

Withdrawal of the outstanding rejections is requested.

Claims 5, 11 and 12 were rejected under 35 U.S.C. §103(a) as being unpatentable over Landgraf in view of U.S. Patent No. 5,333,474 to Imai et al. The patent to Imai relates to a washing machine with a motor system for bi-directional operation of a **single phase** AC induction motor. Like the patent to Landgraf, the motor of Imai is also a single phase induction rotary motor with constant power supply frequency. The speed in this motor is controlled by selectively exciting either one or both of the main and supplemental windings.

This single phase induction motor of Imai has two fixed coils that are spaced 90 electrical degrees apart from each other. These coils are identified as a main coil and an auxiliary coil. The coils each have a fixed number of windings and a fixed inductance. The Imai single phase induction motor has a plurality of operation modes that are achieved by “turning on” or “turning off” one or more triacs connected to the coils so that different coil excitation schemes are achieved by switching in or switching out each entire coil. The single phase motor also includes means for controlling the operation of the triacs so that the motor changes between its different operation modes and different coil excitation schemes when certain speeds are sensed.

In each of these operation modes and its related coil excitation scheme, one or both of the coils are excited so that a rotor rotates in one of two directions. For example, when the motor is in its first operation mode, two triacs 13, 16 are turned on and two triacs 14, 15 are turned off so that the rotor rotates in a counter-clockwise direction.

Conversely, when the motor is in the fourth operation mode, the triacs 14, 15 that were turned off in the first operation mode are turned on, and the triacs 13, 16 that were turned on in the first mode are turned off. As a result, the rotor rotates in a clockwise direction during the fourth operation mode. Additionally, when in the second, third, fifth or sixth operation mode, only one of the triacs is turned on so that only one of the coils is excited. Hence, according to the patent of Imai, when a different set of triacs is operated, the excitation scheme of the spaced and separate coils is changed and different operation modes are achieved. However, contrary to the present invention, the inductance in each of the separate coils of the Imai motor is not varied. Accordingly, like the patent to Landgraf, the patent to Imai cannot disclose the method of varying the inductance of a single coil based on a sensed speed or a motor that accomplishes such a function.

Claim 11

Claim 11 recites a variable reluctance motor including at least one phase module and a system for maintaining motor power comprising a sensor that provides a feedback signal representative of the speed of the motor, a comparing circuit that compares the feedback signal to a reference signal and for generating a switch signal, and a switch coupled to the comparing circuit. Claim 11 further recites that the switch is responsive to the switching signal such that the number of turns of the phase coil is changed from a higher number of turns for a lower operating speed range to a lower number of turns for a higher operating speed range so that the force of the motor is maintained as the speed of the motor changes.

Neither the patent to Landgraf nor the patent to Imai discloses a variable reluctance motor. Additionally, neither of these patents discloses such a motor including a switch that changes the number of turns of a phase coil that can be excited in response to a switching signal. Therefore, as agreed to during the interview, it would not have been obvious to one of ordinary skill in the art to modify the single phase motor of Landgraf with the single phase motor of Imai to arrive at the recited variable reluctance motor because the combination of these publications would not arrive at the recited motor. Withdrawal of the rejection is requested.

Claim 12

Claim 12 recites a variable reluctance motor system including at least one phase coil having a first number of turns. The variable reluctance motor system further comprises a motor speed sensor coupled to the motor and a switch coupled to the phase coil. Claim 12 further recites that the variable reluctance motor system includes a driving circuit coupled to the motor speed sensor and the switch such that the switch changes the number of turns of the phase coil from the first number of turns to a second number of turns when the speed of the motor system reaches a reference value.

As discussed above, the patent of Imai does not include a switch coupled to the phase coil and a driving circuit such that the number of turns of a phase coil that can be excited is varied by the coupled switch when the speed of the motor reaches a reference value. Therefore, as agreed to during the interview, it would not have been obvious to one of ordinary skill in the art to modify the single phase motor of Landgraf with the

single phase motor of Imai to arrive at the recited variable reluctance motor. Withdrawal of the rejection is requested.

In view of the foregoing, it is respectfully submitted that the pending claims are allowable and that the application is in condition for allowance. If any questions or issues remain, the resolution of which the Examiner feels would be advanced by a conference with Applicants' attorney, the Examiner is invited to contact Applicants' attorney at the number noted below.

Respectfully submitted,

By: Brian E. Hanlon
Brian E. Hanlon
Reg. No. 40,449

Banner & Witcoff, Ltd.
1001 G Street, N.W.
Washington, D. C. 20001-4597
(202) 824-3000
Date: 7/1/03

Amended Version Of Claims For U.S. Patent Application No. 09/904,731

In the Claims:

1. (Amended) A method for maintaining the [power] force delivered by a variable reluctance motor including at least one phase coil, the method comprising the steps of:

sensing a speed of said variable reluctance motor; and

varying the inductance of said phase coil based on said sensed speed.

2. (Amended) The method of claim 1, wherein the step of varying the inductance of said phase coil includes the step of [varying] changing the number of turns of said phase coil from a first number of turns to a second number of turns.

4. (Amended) The method of claim [3] 1, wherein the [switching] step of varying the inductance of said phase coil is carried out when said sensed speed reaches a reference speed.

5. (Amended) The method of claim [3] 1, wherein the [switching] step of varying the inductance of said phase coil is carried out when said sensed speed is about the speed at which saturation of a core of a phase coil of said variable reluctance motor occurs.

6. (Amended) The method of claim [4] 1, wherein the step of varying the inductance of said phase coil occurs at approximately [said reference speed is] the motor speed at which the motor force corresponding to a first number of turns (T1) of said phase coil is about the same as the motor force corresponding to a second number of turns (T2) of said phase coil.

11. (Amended) In a motor system including a variable reluctance motor having at least one phase coil, [a] said system [for maintaining motor power] comprising:

a sensor coupled to said variable reluctance motor, said sensor providing a feedback signal representative of a speed of said variable reluctance motor between at least a low range and a high range;

a comparing circuit for comparison of said feedback signal to a reference signal and for providing a switching signal based on results of said comparison; and

a switch coupled to said comparing circuit and responsive to said switching signal such that the number of turns of said phase coil is [switched] changed from a higher [first value] number of turns for said low range to a [second value] lower number of turns for said high range [depending on the value of said feedback signal.], whereby the force delivered by said variable reluctance motor is maintained.

12. (Twice Amended) A motor system including a variable reluctance motor comprising at least one phase coil having a first number of turns, said system further comprising:

a motor speed sensor coupled to said variable reluctance motor for sensing a speed of said variable reluctance motor;

a switch coupled to said phase coil of said variable reluctance motor; and

a driving circuit coupled to said motor speed sensor and to said switch such that said switch [switches] changes the number of turns of said phase coil from said first number to a second number when said speed of said variable reluctance motor reaches a reference value, whereby the force delivered by said variable reluctance motor is maintained.